

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 1 256 357 A2**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
13.11.2002 Bulletin 2002/46

(51) Int Cl.7: **A61M 25/00**

(21) Application number: **02076819.8**

(22) Date of filing: **07.05.2002**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE TR**  
Designated Extension States:  
**AL LT LV MK RO SI**

(72) Inventor: **Meens, Hendrik Jozef Maria**  
**6002 WH Weert (NL)**

(74) Representative: **'t Jong, Bastiaan Jacobus**  
**Arnold & Siedsma,**  
**Sweelinckplein 1**  
**2517 GK The Hague (NL)**

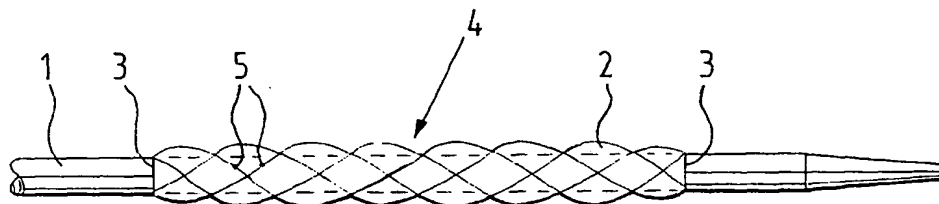
(30) Priority: **08.05.2001 NL 1018018**

(71) Applicant: **Blue Medical Devices B.V.**  
**5708 HN Helmond (NL)**

**(54) Balloon catheter and method for manufacturing it**

(57) The invention relates to a balloon catheter comprising a catheter tube and an inflatable balloon, the ends of which being attached to the catheter tube, whereby the outside surface of the balloon in an unin-

flated state is provided with a relief structure which in an inflated state of the balloon is substantially disappeared; as well as a method for producing such a balloon catheter.



**FIG. 2A**

**EP 1 256 357 A2**

## Description

**[0001]** The present invention relates to a balloon catheter comprising a catheter tube and an inflatable balloon which at its ends is attached to the catheter tube. The invention further relates to a method of manufacturing a balloon catheter.

**[0002]** Balloon catheters of this type are generally known and are used for dilating vessels and lumina. In order to pass the balloon catheter easily and safely through the vessels and lumina and to position it at the required place for dilatation, it is important that the balloon catheter has a small profile and is sufficiently flexible.

**[0003]** The object of the invention is therefore to provide an improved balloon catheter.

**[0004]** The balloon catheter according to the invention is characterized in that the outside surface of the balloon in an uninflated state is provided with a relief structure which in an inflated state of the balloon is substantially disappeared.

**[0005]** Tests have shown that with a relief structure on the outside surface of the balloon, a catheter is obtained that is more flexible than a standard balloon catheter. The balloon catheter according to the invention can therefore be passed more easily and more safely through vessels and lumina to the point of dilatation. Because of its flexibility, the catheter will be able to adapt better to a bend in a vessel or a lumen, thus reducing the risk of damage to the vessel or lumen.

**[0006]** The required relief structure may have different embodiments, but preferably comprises at least one groove that extends at least transversely in the longitudinal direction of the balloon in order to give the catheter the required flexibility in a direction transverse to the longitudinal direction thereof.

**[0007]** The groove preferably extends at a predetermined angle with respect to the longitudinal direction of the balloon. While according to a preferred embodiment the groove extends helically from one end to the other end of the balloon, over the outside surface thereof.

**[0008]** According to another embodiment, the relief structure comprises two or more grooves that extend helically from one end to the other end of the balloon, crossing each other. Tests have shown that with such a relief structure a very flexible balloon catheter is obtained which also has a relatively small profile.

**[0009]** The invention also relates to a method for producing a balloon catheter consisting of attaching the ends of an inflatable balloon to a catheter tube, whereby according to the invention the outside surface of the balloon is provided with a relief structure.

**[0010]** According to an embodiment of the invention, the relief structure is produced on the application of heat in order to deform the elastic material of the balloon.

**[0011]** The relief structure is also preferably produced on the surface of the balloon by applying a high pressure to the inside of the balloon.

**[0012]** According to a very inexpensive method, the relief structure is produced on the surface of the balloon by winding a wire around the balloon in the form of a helix.

**[0013]** According to another simple method, the relief structure is produced on the surface of the balloon by taking up the balloon in a counter-pressure body that has the relief structure.

**[0014]** The invention is explained in more detail on the basis of the drawings attached. The drawings show:

Figure 1A is a side view of a first embodiment of a balloon catheter in an uninflated state;

Figure 1B is a side view of the catheter in Figure 1A in an inflated state, and

Figure 2A is a side view of a second embodiment of a balloon catheter in an uninflated state, and

Figure 2B is a side view of the catheter of Figure 2A in an inflated state.

**[0015]** A balloon catheter according to the invention comprises a catheter tube 1 and an inflatable balloon 2, which at its ends is attached to the catheter tube 1. In an uninflated state (Figures 1A and 2A), the outside surface of balloon 2 has a relief structure 4 that in the inflated state has virtually or completely disappeared (Figures 1B and 2B). The relief structure gives the catheter its required flexibility.

**[0016]** In the first embodiment according to Figures 1A and 1B, the relief structure 4 consists of one groove 5, which extends helically from one end 3 to the other end 3 of the balloon 2, over the outside surface thereof. The uninflated balloon 2 has thereby obtained a helical relief surface. In the second embodiment according to Figures 2A and 2B, the relief structure 4 consists of two grooves 5,6, which extend helically from one end 3 to the other end 3 of the balloon 2 and thereby cross each other. The uninflated balloon 2 has hereby obtained a padded relief surface.

**[0017]** Other relief structures are of course possible, provided that the relief structure on the catheter creates the necessary flexibility in a direction transverse to the longitudinal direction of the balloon.

**[0018]** One way of obtaining the relief structure as shown in the drawings is by winding a wire helically around the balloon 2. If the wire is wound only in the forward direction, the structure according to Figure 1A is obtained, and if the wire is also wound in the return direction, the structure in Figure 2A is obtained. After the wire has been wound around the balloon, a sleeve is pulled over the balloon. Subsequently, with the application of raised pressure to the inside of the balloon, the balloon is heated in such a way that, in an uninflated state, the balloon obtains a relief structure that on dilating of the balloon at the dilatation site in the vessel or lumen will virtually or completely disappear. The sleeve is then removed and the balloon catheter can be inserted into a vessel or a lumen.

[0019] Instead of winding a wire, the balloon may be placed in a mould, which is provided with the relief pattern required in order for it to obtain, under raised pressure and temperature, the relief structure required.

[0020] Before the balloon is provided with its relief structure, preferably it is folded in the usual way in order to reduce its profile. By applying the relief structure, the profile will be reduced still further as an additional, advantageous effect.

[0021] Note that, although it is not shown in the drawings, it is possible to provide the outside surface of the balloon with various helical grooves that cross each other.

loon by winding a wire helically around the balloon.

10. Method according to one of claims 6-9, whereby the relief structure is applied to the surface of the balloon by taking up the balloon in a counter-pressure body provided with the relief structure.

## Claims

1. Balloon catheter comprising a catheter tube and an inflatable balloon, the ends of which being attached to the catheter tube, **characterized in that** in an uninflated state the outside surface of the balloon is provided with a relief structure, which is substantially disappeared in an inflated state of the balloon.
2. Catheter according to claim 1, whereby the relief structure comprises at least one groove that extends at least transversely in the longitudinal direction of the balloon.
3. Catheter according to claim 2, whereby the groove extends at a predetermined angle with regard to the longitudinal direction of the balloon.
4. Catheter according to claims 2 and 3, whereby the groove extends helically from one end to the other end of the balloon, over the outside surface thereof.
5. Catheter according to claims 2, 3 and 4, whereby the relief structure comprises two or more grooves that extend helically from one end to the other end of the balloon and cross each other.
6. Method for producing a balloon catheter comprising the attaching of the ends of an inflatable balloon to a catheter tube, whereby the outside surface of the balloon is provided with a relief structure.
7. Method according to claim 6, whereby the relief structure is applied to the surface of the balloon under the application of heat.
8. Method according to claims 6 or 7, whereby the relief structure is applied to the surface of the balloon under the application of raised pressure to the inside of the balloon.
9. Method according to one of claims 6-8, whereby the relief structure is applied to the surface of the bal-

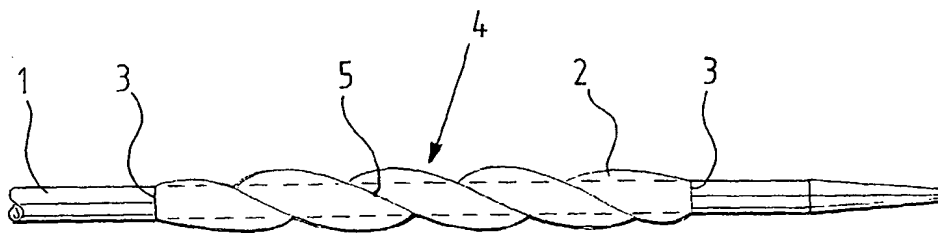


FIG. 1A

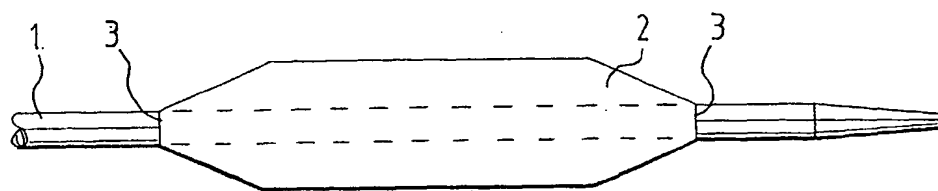


FIG. 1B

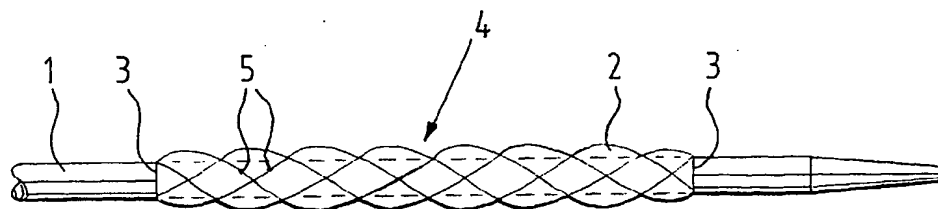


FIG. 2A

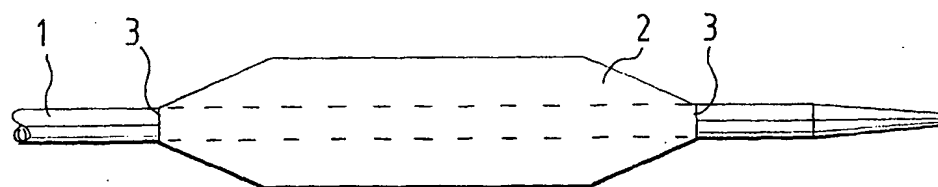
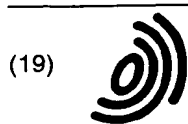


FIG. 2B



(19)

Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 1 256 357 A3**

(12)

**EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
07.01.2004 Bulletin 2004/02

(51) Int Cl.7: **A61M 25/10, A61M 25/00**

(43) Date of publication A2:  
13.11.2002 Bulletin 2002/46

(21) Application number: **02076819.8**

(22) Date of filing: **07.05.2002**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE TR**  
Designated Extension States:  
**AL LT LV MK RO SI**

(72) Inventor: **Meens, Hendrik Jozef Maria**  
**6002 WH Weert (NL)**

(74) Representative: **'t Jong, Bastiaan Jacobus**  
**Arnold & Siedsma,**  
**Sweelinckplein 1**  
**2517 GK The Hague (NL)**

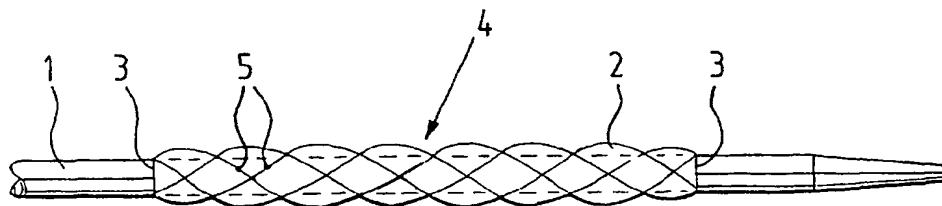
(30) Priority: **08.05.2001 NL 1018018**

(71) Applicant: **Blue Medical Devices B.V.**  
**5708 HN Helmond (NL)**

(54) **Balloon catheter and method for manufacturing it**

(57) The invention relates to a balloon catheter comprising a catheter tube and an inflatable balloon, the ends of which being attached to the catheter tube, whereby the outside surface of the balloon in an unin-

flated state is provided with a relief structure which in an inflated state of the balloon is substantially disappeared; as well as a method for producing such a balloon catheter.



**FIG. 2A**

**EP 1 256 357 A3**



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application Number  
EP 02 07 6819

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 545 132 A (KLING JEFFREY ET AL) 13 August 1996 (1996-08-13) * column 5, line 20 - line 36 *	1-6	A61M25/10 A61M25/00
X	US 5 891 386 A (DEITERMANN MORRIS H ET AL) 6 April 1999 (1999-04-06) * column 3, line 65 - column 6, line 27; figures *	1-4,6-10	
A	EP 0 737 488 A (CORDIS EUROP) 16 October 1996 (1996-10-16) * claims 1-7; figures *	1-10	
A	US 5 295 959 A (GURBEL PAUL A ET AL) 22 March 1994 (1994-03-22) * column 11, line 13 - column 12, line 45; figures *	1-10	
A	EP 1 008 363 A (JANACEK JAROSLAV) 14 June 2000 (2000-06-14) * abstract; figures *	1-10	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			A61M
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 14 November 2003	Examiner Kousouretas, I
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FCM 1503 03 82 (PC4C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 07 6819

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-11-2003

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5545132	A	13-08-1996	DE	69430486 D1	29-05-2002
			DE	69430486 T2	21-11-2002
			EP	0735906 A1	09-10-1996
			ES	2176314 T3	01-12-2002
			JP	9506805 T	08-07-1997
			WO	9517223 A1	29-06-1995
-----					
US 5891386	A	06-04-1999	NONE		
-----					
EP 0737488	A	16-10-1996	NL	1000106 C2	11-10-1996
			US	5759172 A	02-06-1998
			EP	0737488 A1	16-10-1996
-----					
US 5295959	A	22-03-1994	AU	3800993 A	05-10-1993
			CA	2131376 A1	16-09-1993
			DE	69320034 D1	03-09-1998
			DE	69320034 T2	15-04-1999
			EP	0630274 A1	28-12-1994
			JP	2736823 B2	02-04-1998
			JP	7507697 T	31-08-1995
			WO	9317748 A1	16-09-1993
-----					
EP 1008363	A	14-06-2000	US	6129706 A	10-10-2000
			EP	1008363 A2	14-06-2000
-----					

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82